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SCIENCE

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To the Readers of [illegible]*NCE:*

During the past year it has been found possible to enlist the interest of scientific workers in the success of *Science* to such an extent that more than eight hundred have promised contributions during the coming twelve months. Not only are contributions of merit coming in ever increasing numbers from American scientific men and women, but we are now securing our first contributions, in any quantity, from abroad.

We know that this development in the usefulness of *Science* is appreciated, not only from the many kind letters received, which are always inspiring and which we wish our friends would mark as at our disposal for publication, but from a marked increase in the number of new subscribers.

Science owes its existence to the munificence of two gentlemen, whose names we do not feel at liberty to publish, who contributed very nearly $100,000 toward the support of the paper in its early years. There is no longer need of such liberal subsidizing, but we do need cash subscriptions from all who feel at all interested in a weekly journal of science in America.

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SCIENCE

NEW YORK, SEPTEMBER 30, 1892.

THE EFFECTS OF CIVILIZATION ON OUR BIRDS.

BY MORRIS GIBBS, M.D.

In scanning the notes of any reliable observer, in the ornithological field, of twenty years' standing, one of the most noteworthy features presented is found in the many allusions to the frequency or infrequency of various species formerly abundant or unknown. We find numerous notes like this: "Seldom seen; formerly abundant," or, more rarely, "common; exceedingly rare years ago." These conflicting notes are of peculiar interest to everyone in any way concerned in the welfare of a community, and cannot fail to excite speculation among those who have noted the changes. The changes, either gradual or sudden, have resulted from natural or unnatual causes in many and devious ways. Unnatural is a word perhaps improperly used here, even allowing that civilization has eradicated many species from the globe. We had best look at man only in the light of an animal when we are to compare him in nature, and we can but acknowledge that the civilized state is simply in advance, and, in which we are simply better adapted to perform the work of extermination or cultivation.

It is easy to account for the appearance or disappearance of some species, and, with many, the reasons assigned are so self-evident that the generally accepted theories are rarely disputed. With our game birds, it is duly acknowledged by all capable of reasoning that the cause of the disappearance, as in the case of the wild turkey, *Meleagris gallopavo*, from well-populated districts, is entirely due to persecution by the gunners. However, there are many cases of unlooked-for changes; increase or decrease of numbers, for which we are not fully able to account. The writer, having carefully studied the subject for ten years, and with the assistance of nearly a quarter of a century of his own observations, feels confident in presenting some conclusions. These deductions may not be correct, but may at least promote investigation and inquiry into the subject by others more capable of explaining.

The causes of local change, in scarcity or abundance, as regards animal life, varying migrating routes, and ultimate disappearance, or other reasons, are many and peculiar, but may, I think, be grouped collectively under the following two heads:—

I. Natural causes, or features arising from other causes than those resulting from civilization. These are many, so far as we are able to judge, but are hardly to be considered here. They come under that division normally included in the evolutionist's province.

II. Unnatural causes, or those changes occurring from causes aside from the direct effects of nature; that is, more through the direct effects of civilization. These various changes may be discussed under the following divisions; remembering always that the system, as a whole, depends on the changes resulting from man:—

a.—Proximity of the habitations of man.

b.—Removal of forests and general clearing of vegetable growth.

c.—Drainage of land.

Under the first heading may be considered the most serious incursions in the ranks of our feathered neighbors, as it is chiefly due to the nearness of sportsmen and unsportsman like individuals, as well as to the demands of milliners and the small and reasonable wants of scientists and collectors, that the birds, game, plumaged, and song, are principally sought. In addition to these well-known causes for total disappearance, or great diminution in numbers, we may add many hundreds of causes that contribute in a greater or less measure towards this end. Anyone of an observing turn must have noticed the multitude of ways which help towards decimation. A few causes may be mentioned from the innumerable series to only suggest the dangers of proximity of the habitations of man. The light-houses of our great lakes and coasts kill many thousands each year, and perhaps hundreds of thousands, the birds killing themselves by dashing against the lights when migrating seasonally. It may well be doubted if there exists an invention, with the exception of the gun, more deadly to the birds than the electric light. Then there is the head-light of the locomotive, and the very destructive telegraph and other wires, which form a net-work throughout the country. In fact, there is hardly a cause from which man himself dies, through accident or design, which does not likewise destroy our birds. Hanging, drowning, and cremation are not rare causes of their taking off. Fires in particular are damaging means each year, particularly when occurring in wild half-clearings, stubble-fields, and virgin forests, in the spring and summer; but perhaps the most destructive fires are those that ravage large prairie sections where the prairie species nest. Without a doubt, early settlers, both in wooded as well as prairie lands, are guilty of a fearful devastation to both song and game birds in their efforts to clear up and improve the land.

As far south as I have been in the United States, and our line extends nearly to the tropics, and on the north to Lake Superior, I have met with plumage collectors for the "dear ladies'" wants. The blue-jay, tanager, and oriole cannot migrate too far north in our land to escape persecution in behalf of that travelling side-show, the feminine head-gear, and no matter where you go in the south, if it is in the everglades of Florida, you will find the plume-hunter busy for the almighty dollar, which he frequently gathers by shooting the parent birds at their nesting-sites, leaving the squabs to starve in their nests. One man (?) told me that he had shot two hundred white and snowy herons at one rookery in southern Florida; and this all for the money paid by vain, self-adorning women. Perhaps I have said more than is required on this subject, but many will not think an excuse necessary.

It is hardly worth while speaking of the destruction of game and other birds by the gun, net, and trap, as these methods of extinction have been so thoroughly canvassed that they are at least understood by all reasonable men. The havoc made on our wild pigeons with the set net is well known, and the sentiment is voiced by all that we would still have plenty of pigeons had the nets not been used, contrary to law, near the breeding-grounds.

Although so many species are noticeably diminished in numbers through the advent of advancing civilization, there are a number of birds which have become much more abundant, and a few even which have become residents or occasional or annual visitors, which were formerly not found in this section. Among them, here in Michigan, the most remarkable are in the cases of the robin, crow, black-throated bunting, meadow lark, orchard oriole, and turkey buzzard. All of these species were unknown near Kalamazoo in 1832, though they may have been recorded from the vicinity of Detroit, which was a much older settlement. About the year 1835 the robin appeared, lured hither by the social relations which have ever existed between civilization and these pleasing birds. The crow did not arrive till 1850 or later, and was not common till 1875, yet now it bids fair to become as great a nuisance in our State as it has proven in the East. The old settlers assert that the orchard oriole and meadow lark were not here at an early day, and though we cannot attest when they did first appear, we are convinced that it is through the influence of civilization that they are so abundant now. In this, Kalamazoo, county the black-throated bunting was unknown twenty years past, yet the notes ***dick sissel sissel*** may now be heard from almost

every clover-field, in June, in Michigan, south of 43 degrees. About 1870 a specimen of the turkey buzzard was captured here, and for a long time this note was unique, but within the last few years they have become regular summer visitors, and they have been found nesting at about 43° north latitude, on Lake Michigan's shore. There are dozens of other instances of cases where birds formerly unknown hereabouts, or but rarely met with, have, within the last twenty years or so, become comparatively common, or even abundant.

The second civilized cause of the unnatural means of change, namely, removal of forests, is remarkable in its effects, and yet, although more birds are forced to leave neighborhoods totally denuded than there are new species to occupy the locality, still a county about two-thirds cleared and well peopled is sure to embrace more species of birds than is one with its trees all standing. In a four years' residence at the north and in a new county, I was, although on the alert, and daily making notes, able to secure a list of only one hundred and twenty-odd species; while here, in a district inhabited over twice as long, and with over nineteen-twentieths of the area cleared, I have a list of over one hundred greater.

A locality where the trees were all felled would not contain a hawk, owl, woodpecker, grouse, warbler, fly-catcher, jay, crow, and many other species; but there are also many species, as house-wrens, barn and eave-swallows, chimney swifts, robins, blue-birds, sparrows, and finches of several kinds, kingfishers, and all the plovers, snipes, sandpipers, ducks, geese, and divers, which could remain with us, and many of which would not appear at all if the country was covered with forest.

The only species which I am satisfied are disappearing rapidly from the devastation of forests are the black woodpecker and wild turkey; of these, both once common, the turkey is being exterminated, while the log-cock has sought other quarters and is seldom seen here now. The raven, once abundant hereabouts, has gone forever, while its place is taken by its near relative, the crow, which was once not found in this locality.

Perhaps under this heading we may properly mention that group of birds which have modified their nesting habits to suit the requirements in order to associate with man, and, as we might say, secure his protection. A remarkable instance is that of the so-called cliff-swallow, a bird which has appropriated the space around buildings under the eaves, and which is well known to the boys as the eave-swallow. It is impossible to say how long this modification has existed, but certainly not longer than three centuries, for even now the species clings to its primitive choice of location in the west, still sticking its mud-pellet habitation to the cliffs. The white-bellied swallow, house-wren, white-bellied nut-hatch, and blue-bird, all have modified their nesting habits to an extent, and occasionally occupy boxes and other receptacles placed for their accommodation. The common pewee boldly enters our barns, out-houses, and even attempts to occupy a nook on the front porch, from which it is unceremoniously ousted. Some years ago I found two pewee's nests built in the original style; they were attached to the roots of overturned trees. This was undoubtedly the primitive method of the pewee, until the fortunate appearance of civilized man, when little pewee quickly came to know an advantage, and he adopted buildings and bridges instead of overturned tree-roots.

The barn-swallow must have adopted the custom of building in the peaks of buildings many generations ago, for no one knows of its ever nesting otherwise. It is even said that the martin was provided with gourd houses before the discovery of America in 1492, and that the natives afforded protection to this favored bird. It now accepts the boxes erected for it, or nests in the cornices of buildings in our cities and towns. The chimney-swift is the best example of a species changing from a life in the solitudes to the busy scenes of village and city. Once the swift must have nested in the cavities of trees, and I have heard of nests being found in huge, hollow sycamores, but at present the birds almost confine their nesting haunts to unused chimneys.

The third cause of change, viz., drainage of land and water, does not produce the great influence that the removal of forests does. Nevertheless, it exerts more of a change than one would credit. Many places where rails once nested in abundance, and ducks annually stopped on their migrations, are now comparatively dry fields and yield good crops. However, these drainings are almost compensated for by the overflow occasioned by the damming-up of streams and the outlets of lakes, as a head for mills, and, further, where lakes have been lowered by various means, it has not infrequently happened that the uncovered shore-line, so increased, has offered attractions to certain littoral species which were formerly rare, but which are now taken seasonally during migrations.

Enough could be written on this subject to fill a book, but space forbids further comment. It has been plainly shown that peopling a locality, with not too heavy a sprinkling over the agricultural portion, and not too heavy a removal of the trees, actually increases the number of the species of birds, and, with a few exceptions, principally the ducks, increases the number of birds. Though our little corporation does not contain as many birds as formerly, as they are crowded out, I am satisfied that there are in our county each year at least fifty species of birds unknown to the locality fifty years ago.

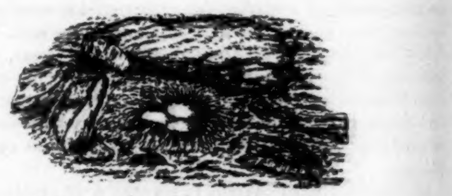
Kalamazoo, Michigan.

THE DUCK ISLANDS.[1]

BY LEVI W. MENGEL, ENTOMOLOGIST TO WEST GREENLAND EXPEDITION, 1891.

We left Upernavick toward noon of July 1, with the "Kite's" head to the north-west. On the following morning we were awakened by the cry of "Land, Ho," and upon reaching the deck saw in the distance several small specks, which we were told were the famous Duck Islands, so-called because almost their only inhabitants are the American Eider Ducks which congregate there in the summer to breed.

The party immediately began to prepare for the day's work, and at four o'clock we brought up under the lee of the largest of the islands. The Duck Islands are situated about 73° north and 58° west, and are three in number. They are all small, the largest



AN EIDER DUCK NEST.

not being more than a mile and a half in diameter; all near together, and composed of the same kind of rock, which appeared to be granitic or at least of some igneous origin.

Our party were soon ready to go on shore. A gun was fired from the ship, and a black cloud of birds arose from the islands. They flew a short distance and then alighted, most on land, yet some in the water. We were soon on shore, and then began a day of sport and slaughter. A portion of the party was detailed to gather eggs and down for the use of Lieutenant Peary in the far north. The remainder of the party were to gun for as many birds as they could get; and we got them. Seldom did a shot fail to bring down a bird, and from every portion of the islands came rapid reports which told of slaughter and death. One could not walk even a short distance before coming to a nest, and not unfrequently did the female wait until almost trodden upon before flying. The male birds betook themselves away upon the first scent of danger, and upon the water nearby, just provokingly beyond gunshot, could be seen numbers of them, many wounded but sufficiently active to keep away. Of the birds shot the females largely predominated, probably ten to one.

The nests of these birds were all built on the ground (see illustration), some on the open, and some few under the shelter of

[1] The plates have been kindly loaned for this article by Dr. R. N. Keely, Jr., of Philadelphia, and are from his excellent narrative "In Arctic Seas."

large rocks and boulders. They varied somewhat in size, though averaging about a foot in diameter, outside measure. They were uniform in color, made of fine feathers and down plucked from the breast, the whole effect being dull gray. The eggs were from three to six in number, of a dull grayish-green or drab color, which varied slightly in the different nests. The average of fifty-one eggs from thirteen nests is 3.05×2.00. The female, if startled, deposits excrement, and partially covers the nest with down by a quick back motion of her feet. In many nests examined this was not the case, and in all probability the female was away feeding at the time of our arrival. Nearly all of our party reported the same in the nests of startled birds. Whether done to conceal the eggs or whether done through fright is entirely a matter of conjecture.

At the time of our visit to Duck Islands, incubation was begun in nearly all cases; in many far advanced; and though several barrels of eggs were collected, there were but very few which would be of any use to Peary. The birds, though to us they seemed very abundant, were thought by Captain Pike to be rather scanty in number. Probably some Arctic whaler had been there before us. This supposition may have been correct, as the sets

DUCK ISLANDS.

of eggs we collected contained but from three to six, while most authorities give from six to ten as the normal number.

Besides the eider ducks, there was but little else of interest on the islands. Two or three snowflakes, *Plectophanes nivalis* (Linn) Meyer, a northern phalecope, *Lobipes hyperboreas* (Linn), Cuv., and a single king-eider, *Somateria spectabilis* (Linn) Boie, made the entire list of birds. Several spiders and an ant, which was not caught, made up the rest of animal life observed; although there were several pools which looked as if they might be worthy of investigation.

The "Kite" had been steaming constantly from place to place, to avoid the bergs floating in the vicinity; and at 12 M., much against our wishes, we were recalled to pursue our journey northward.

Reading, Pa., Sept. 19.

PREPARATION OF TEACHERS OF SCIENCE AS CARRIED FORWARD IN THE MICHIGAN STATE NORMAL SCHOOL.

BY E. A. STRONG.

THE list of towns and villages in our country having a population below 20,000, or even below 10,000, is a large one. In these towns the number of pupils who attend a public high school is relatively much greater than in the larger cities, partly because these schools receive considerable accessions from the surrounding country, and partly because the smaller towns are not well supplied with private and technical schools to divide the attendance. So it comes about that a large part of the membership of the public secondary schools of our land is found in the villages and minor cities. In many of these towns education is a leading interest, the teachers are a favored and highly respected class, and the schools are managed with vigor and intelligence.

Now it is in the schools of these smaller cities and villages that the graduates of the numerous normal schools of our land find employment, either as superintendents, principals, or instructors. The district or rural schools rarely feel that they can retain the services of a trained teacher, so that the constant effort of normal faculties to induce their graduates to "go into the country and build up the rural schools" are only moderately successful. In the large cities the corps of teachers is usually recruited from the local high school or training school with little aid from without, and thus it becomes the distinctive work of the normal schools to give tone to education in communities too small to support a training school.

This is a great work, and it need hardly be said that it yet wants much of even reasonably complete accomplishment. Still, during the past few years there has been great improvement in the training of teachers, and the normal schools of the land are coming to deserve more and more the interest and sympathy of the friends of sound learning. A concrete example may best exhibit what the normal schools are doing or attempting, and the department of the physical sciences in the Michigan State Normal School will be used for this purpose.

Of the thousand students in this school rather more than one-half take the full or four-years' courses, and about one-third of this number specialize their work in the direction either of the biological or the physical sciences. Of those who elect the physical sciences about 63 per cent have during the past five years come to the school certificated as graduates of "approved high schools," 19 out of a class of 21 being the largest ratio and 18 out of 63 the smallest. Of those who went out from the school between the years 1885 and 1890, 86 are teaching or have taught physics in some high school, and fifty-four are teaching or have taught chemistry. These numbers seem small; but it must not be forgotten that many of these people take up teaching as a life-work, and that the number of normal schools with a presumably similar or better record is very considerable.

The teaching force in this department is supplied by three instructors, with some regular and efficient assistance from advanced pupils, many of whom are teachers of experience. The department occupies three floors in the south-east angle of the building. Upon the lower floor is a shop, 33 feet by 28 feet, with a modest equipment of lathes, benches, and tools; a physical laboratory, 34 feet by 54 feet, supplied with water, gas, stone and oak tables and benches, a water-motor, a small dynamo and accessories, and a considerable collection of American, English, and German apparatus for measurement; a store-room, twelve feet square, containing cases for apparatus, one side of the room being used as a balance-room; two dark rooms, each 6 feet by 15 feet, with optical benches and the usual equipment for photometry and lens work, one side of one of the rooms being fitted up for primary batteries. Upon the middle floor is a recitation-room and laboratory for elementary physics, 34 feet square, furnished with recitation seats and tables for students' work, cases for students' apparatus and demonstration tables; an apparatus-room, 12 feet by 30 feet, with cases for demonstration, apparatus and tables for teachers' use; and a recitation-room and laboratory for higher physics, 20 feet by 24 feet, with the necessary furnishings and equipment. The third floor is devoted to chemistry, and contains a lecture-room, 20 feet by 24 feet, a laboratory 34 feet square, with tables for 40 students, and a work and store-room 12 feet by 30 feet, all with the usual fittings, apparatus, and appliances.

The course of study of this department contains the following titles: 1, Physics I.; 2, Physics II.; 3, Physical Laboratory Practice; 4, Training in the Physical Sciences; 5, General Chemistry; 6, Advanced Chemistry; 7, Physical Technics, including Advanced Laboratory Practice; 8, General Astronomy; 9, Advanced Physics; 10, Instrumental Astronomy; 11, Sanitary Science; 12, Meteorology.

The first five subjects in this list are taken by nearly all intending teachers who graduate upon the four-years' courses, and are designed to give some knowledge of the content and the methods of the physical sciences and such skill in manipulation as are needed in general teaching. The three numbers following also form a natural group designed to meet the wants of special teachers of the physical sciences. The last three are post-graduate subjects. Physics I. is a course, complete in itself, consisting of a daily lesson for twenty weeks, with additional laboratory work, upon molecular and mass mechanics. Special prominence is given to the states and properties of matter and the transference of energy. Physics II., a course of the same extent upon sound, electricity, and light, is also made complete within itself as far as possible to meet the wants of those students who have had a brief course in physics elsewhere, but who wish to extend their knowledge of these subjects. For most pupils the two form a continuous course of one year, with supplementary practical work.

The only condition for entering upon this subject is the completion of algebra and plane geometry; but the high average age of the members of the class, — between nineteen and twenty, — coupled with the fact that a large number of those who enter upon this subject have already completed elementary physics in one of our excellent high schools and desire to review and extend their studies in this direction with reference to teaching, permits and invites a strong and extended course.

The experimental work is of two sorts, teacher's class experiments or demonstrations and students' individual work carried forward at their tables. Our experience would indicate that the former cannot be entirely omitted without loss. A piece of apparatus does not teach its own best use. The student who knows how to investigate thoroughly and to question himself wisely has already passed the elementary stage of scientific work. As to the character of this demonstration apparatus, a portion consists of the ordinary apparatus sold by dealers, but a still larger portion is derived from the home, the farm, and the workshop — commercial, working pieces. Important demonstrations are repeated by pupils before the class, so that they may get a feeling for artistic demonstration and neat manipulation before a class. This is regarded as very important, though it is far easier to gain this ability than the power to question wisely. The catechism is the infinite matter.

In addition to these daily class demonstrations, our course contemplates students' individual work, mainly in measurement, two afternoons a week after the "collective" system. That is, each member of the class has a piece of apparatus exactly like that of the others, and does the same work in the same time. So each student is supplied with a balance in case, turning easily with one milligram, with fine weights; a set of burettes and measuring glasses, English and metric units divided with accuracy, and, in general, examples of the simpler apparatus in dynamics, heat, electricity, and optics.

As to method, a very important part of the work is presented inductively. That is, physical changes are observed and described by members of the class; the conditions upon which these changes depend are then varied in many cases and in many ways, and in each case the pupils are asked to observe and describe. Wise questioning leads the class to distinguish that which is constant from that which is variable in these changes until the law which governs them comes spontaneously into view and is fully apprehended and formulated. With somewhat similar material and under somewhat similar circumstances the pupil repeats the work at his own table. Further illustrations, exercises, and problems follow. If a book is used — as is the case in a portion of the work — the subject is assigned as a lesson to be recited in good form — the least valuable part of the work, but still not without value. So, by the exhibition of material and wise questioning, the pupil passes from the observation and statement of fact to the apprehension and statement of law. It hardly needs to be added that this so-called inductive method is not identical with the method of discovery, since the student would not of his own instance know what experiments to try or what questions to ask; but from his point of view he is a real discoverer of fact and law, and the process has to him the interest and especially the suggestiveness of discovery.

The method of verification and illustration is also freely used, by which that which is dubiously or imperfectly known is brought into fuller knowledge. This method blends easily with the preceding. Resort is had to the method of authority for those numerous cases in which experiment and verification are impossible under the circumstances. This is especially necessary in the case of a teacher, who needs to have a complete view of his subject, and who must appeal to book or lecture for the ground of much of his knowledge. This knowledge of what other people have found to be true is so vivified by the more vital knowledge that the student has gained for himself by similar methods, that it is neither unreal nor unfruitful. Much attention is given here and elsewhere to the selection, care, and use of apparatus, to the graphical method of recording facts, and to the bibliography of physical science.

3. Laboratory Practice. This consists of "separate," or individual, work for ten weeks in physical measurements, following and completing the preceding courses. As the members of the classes in laboratory practice have passed over the whole of elementary physics, they are prepared to take any experiment within the range of this subject. Each student works with a different piece of apparatus and continues its use until he has mastered it and secured the highest attainable results. Thus it is not necessary to duplicate pieces, and this saving in the cost of extensive duplication is applied to the purchase of apparatus of a higher grade and of greater variety than would otherwise be possible; and thus the course is made more extended and exacting than it could be under the "collective" system. Moreover, many pieces of apparatus in mechanics and heat have optical or electrical accessories which can be understood and put into action only by students who have completed a course in physics. But the real reason for preferring the "separate" system in any serious work in laboratory practice is the facility which it affords for individual and independent work according to observed capacity and advancement. No text-book is used, but exercises are set from a printed list containing references to Pickering, Stewart and Gee, Glazebrook and Shaw, Worthington, Whiting, and other authors, with whose works the laboratory is supplied.

4. Training in the Physical Sciences. This is a course in methods, and consists of two parts — theory, presented by quizzes, lec-

tures, and reading; and practice, in which the members of the class taking the scientific course teach the elements of this subject for a term of weeks in the school of practice. The philosophy of methods rather than a definite course of practice mainly engages attention, and yet that most difficult special problem in modern pedagogy, how to teach the elements of the sciences in a real way to pupils below the high school, is attacked with vigor, and a possible course is marked out and illustrated in detail. Much time is also given to practical work in the smaller high schools. The course of reading in this class is quite extended, and its members become somewhat familiar with the best European and American methods of teaching secondary physics.

5, 6. Chemistry and advanced chemistry. In these subjects the members of the scientific course complete Remsen's "General Chemistry," Jones's "Junior Course in Qualitative Analysis," and have ten weeks' quantitative work. The work is arranged with special reference to teachers. The students have much practice in demonstration before the class, in the preparation of apparatus and reagents, in gas analysis, in blowpiping, and the attempt is made to interest each one in some sort of practical work which he will be able to continue, and in some chemical periodical which he will desire to read as a teacher.

7. Physical Technics. The subject of this course is the laboratory method, which is here viewed from its practical side as it is from its theoretical side in the course in training. Robins's "Technical School and College Building" is made the authority in most matters of construction. The members of the class make detailed plans and specifications for fitting up an ordinary schoolroom as a laboratory for physics or chemistry or both, and with various degrees of elaboration; prepare lists of apparatus of varying cost from $50 to $1000; and report in full, with drawings and price-lists, upon some high-school or college laboratory which is visited for this purpose. All do much practical work in making and especially in repairing apparatus; construct some important piece; have much practice in testing balances, galvanometers, etc.; report monographically upon some assigned topic, as, for example, the best form and material for fine weights, the spiral-spring balance as an instrument of precision, comparison of photometers, conditions determining the size of drops, etc.; and have much careful and continued practice with at least two instruments of precision, which were in general used with less completeness in the regular laboratory course, as the spectroscope, the saccharimeter, the sextant, the astronomical transit, etc.

8. Astronomy. The essence of this work consists in the actual observation of the heavens with the unarmed eye, an opera glass, and a small telescope during one school-year. Great familiarity with the constellations is secured, and a full set of drawings showing the observed motion among the stars, and the telescopic appearance, at frequent intervals, of the moon and the planets visible under favorable circumstances during the year. A good high-school text-book is incidentally gone through with.

9. Advanced Physics. The objective point here is a mathematical view of physical science and the ability to read the stronger scientific books and periodicals with ease and profit. Those who enter the class have had work in trigonometry, higher algebra, and the calculus, and are able to master an advanced text-book. Much practical work is also done with the purpose of leading the members of the class toward some course of study or investigation to relieve and vivify their subsequent teaching. The post-graduate work will not be described as it has not yet become important.

It may be asked whether this preparation is sufficient to make a well-furnished teacher of science. For myself I would frankly answer, no. The highest attainable preparation is not sufficient, it is only hopeful — in the way to become sufficient. Our candidate for success as a teacher has been all along taught that the first condition of success is intimate and exact knowledge of his subject. He already has some knowledge and has been put in the way of getting more, and surely this is a hopeful condition. If it were further queried whether this man would not have done more wisely to attend a technical school or college for four years as a preparation for teaching science rather than give a large part of his time to English, history, mathematics, and German, to the study of children, to practice-teaching, and to the history and philosophy of education, I would reply that it depends upon who the man is. A native talent for teaching or exceptional knowledge and love of young people may render the intending teacher independent of formal professional instruction; but it is my own observation continued for many years as principal of a large high school and superintendent of a system of schools, that the normal graduate will be the more painstaking and studious man, and that he will, in the long run and with important exceptions, do finer, sounder, and more rapid teaching than the technical student. At any rate he has fairly emerged upon the field of advanced secondary instruction and deserves recognition and interested and sympathetic criticism.

Ypsilanti, Mich., Sept. 17.

NOTES AND NEWS.

A PARISIAN Inventors' Academy is distributing letters to inventors in this country, informing them that "after examination of your last invention the Academy has conferred upon you the title of Honorary Member (*Membre d'honneur*) with award of the first-class Diploma and the Great Gold Medal (gilded)," on receipt of ten dollars to defray the cost of the gilded medal, etc. We advise our readers, if so addressed, to consider the value and probable standing of that institution very carefully before sending on their ten dollars. A note to our consul in Paris might assist them in securing such testimony as they may require on this point.

— Recently a communication from the Lick Observatory recorded a phenomenon which was thought to be as unique as it was beautiful. Fog filled a valley, and upon its level surface the mountain peaks were mirrored as if from a placid lake. Strangely, in the *Yorkshire Herald* of Sept. 7, "An Early Riser" records a precisely similar phenomenon at 6 A.M. on Sept. 5; It was seen from Leyburn, which overlooks Wensleydale. This lovely Yorkshire valley was half filled with fog, which looked like a mighty flood or lake. Upon it the opposite slopes, lit up by the bright sunshine, were reflected with "extraordinary distinctness."

— G. P. Putnam's Sons have in active preparation an edition of the "Works of Thomas Paine," which will be edited by Moncure D. Conway, author of "The Life of Thomas Paine" which they have just issued. The set will be in two or three volumes, the first division being devoted to the political and sociological writings, and the second to the religious and literary papers, of which the most important is "The Age of Reason." The volumes will be uniform with Mr. Conway's biography, and will include essays of importance not in any previous collection

— In "A Chapter in Meteorological Discovery," in the October *Popular Science Monthly*, Mr. John Coleman Adams presents Benjamin Franklin as the father of American meteorology, and shows the part which Redfield, Espy, Dr. Hare, Professor Loomis, Blodgett, Mitchell, Coffin, and Dr. Joseph Henry have severally had in building up the science. A philosophical discussion, of much value and interest to thoughtful people, of the best methods of really learning foreign languages is given by Dr. Howell T. Pershing, in an article on "Language and Brain Disease." A curious and liberally illustrated article on the "Evolution of Dancing," by Lee J. Vance, shows how the custom has been largely derived from the religious, mystic, or festive exercises of the human races in the earlier stages of their civilization, and illustrates the various forms which dances assume among different peoples. Pertinently to the present vogue of the "Keeley Cure," Dr. T. D. Crothers discusses the merits of the various specifics for the cure of inebriety that have claimed attention at different times. An important article will appear on the disadvantages which the conditions of modern city-life throw in the way of the best physiological development of children, by Dr. Henry Ling Taylor. The subject is fully reviewed in a philosophical manner, and the attempt is made to measure the influence for good or ill which each of the factors in which city conditions differ from those of the country exerts upon the child's bodily and mental faculties.

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Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

THE FICTION OF THE AMERICAN HORSE AND THE TRUTH ON THIS DISPUTED POINT.

BY DR. E. L. TROUESSART.

THE article of Mr. Robert C. Auld, published in *Science*, Sept. 2, 1892, brings before us the question of the introduction of the horse (*Equus domesticus*) into America, It is generally accepted that Europeans brought it to the New Continent, and that it was in La Plata that Mendoza, in 1530, introduced horses. Before that time, the natives were familiar with the llama only.

The only document which contradicts this historical fact, is a map published by Sebastian Cabot, on his return to Europe, that is after 1530, and which, moreover, had several editions. On this map, Cabot figured the horse as a production of the Rio de la Plata. It is difficult to attach any faith to this assertion of Cabot, since it depends very probably, upon the same doubtful grounds as the existence of the gold and silver mines in this country to which he gave, fortunately or unfortunately, the name of "La Plata." We know that all the objects of gold and silver which Cabot obtained from the natives were brought from Peru and from Chili, and that no metallic productions of any kind are to be found in this part of the Argentine Republic. But to Cabot—desirous above all things of dazzling the King of Spain, and later the King of England, in order to obtain the command of new expeditions for discovery—it was essential to make it appear that these lands abounded in riches and supported large herds of horses. It is quite likely, too, that Cabot knew that the horse, recently imported into the country, could survive there and multiply in a state of freedom.

Be that as it may, all navigators who visited Rio de la Plata, before and after Cabot, contradict his assertions and agree in affirming that the natives did not know the horse. Pigafetta, notably, the historian of the voyage of Magellan, who visited Rio de la Plata in 1519, and who enumerates with care all the productions of the animal and vegetable kingdoms of that country, says authoritatively that the natives knew no other beast of burden than the llama (*guanaco*).

It is time, therefore, to make an end of this fiction of the native American horse. It is certain that this animal was imported by Europeans into America and that the *Equidæ*, which had formerly existed on that continent, were entirely unknown to the red men. We recall the terror of the Caribbeans, the Mexicans, and the Peruvians, at the sight of the Spanish cavaliers: they believed themselves in the presence of a herd of centaurs. Geological and palæontological evidence in regard to the Argentine Republic abounds, also, to prove, in the most convincing manner, that there elapsed a period, between the extinction of the indigenous American horse and the appearance of the domestic horse imported from Europe, which was quite long enough to be appreciable geologically. This is the point which is now to be demonstrated.

We know that the horse of three toes (*Hipparion* or *Hippotherium*) existed in the north of the two continents at the end of the tertiary period (Pliocene and Quaternary). The genus *Protohippus*, considered the direct progenitor of *Equus*, differs very little from *Hipparion*, and may be regarded as a simple sub-genus of the latter. This genus, *Protohippus*, which numbers several species, lived in North America during the Pliocene epoch. The true genus, *Equus*, appeared soon after in the same country (from the Pliocene epoch), and several species (*Equus crenidens*, *E. barcœni*, etc.) are contemporaneous with *Hipparion* and *Protohippus*.

A genus akin to *Equus*, the genus *Hippidium*, is found also in the Pliocene age of North America (*Hippidium spectans*, Cope). This genus is the only one (with the true *Equus*) which is found in the Quaternary epoch in South America. Indeed, *Hipparion* and *Protohippus* are not known there, and *Hipphaplus* (*Ameghino*) is too little known to take up our attention here. There seems to be no doubt, therefore, that the South American horses of the Quaternary age spread gradually across the continent, from Mexico to Colombia, Brazil, and the Argentine Republic, for before this period *Macrauchenidæ*, the *Proterotheridæ* and the *Tapiridæ* were the only Perissodactyls living in the last-named country.

The South American horses (genus *Hippidium*) bear characteristics which forbid confusing them with the Hipparions and the horses of the North. Those of South America had thick, squat bodies, large heads, slender legs tapering to small hoofs; their molar teeth were of a shape more square than those of the true horse. These peculiarities are found again, in a measure at least, in horses of the same country which have been referred to the true genus *Equus*. In the same way, the *Equus lundii* of Boas, which lived in Colombia in the Quaternary period, has been compared to the zebra because of the thickness of its form. The other species which were found in the Argentine Republic are *Equus curvidens*, *E. argentinus*, and *E. rectidens*; this last is the one which lived longest in this country where it must have been hunted and eaten by prehistoric man. In the "étage platien" (upper Quaternary) are found bones of this horse (*E. rectidens*) associated with chipped-stone implements, with pottery, fire refuse, etc., which are the evidences of the presence of man. The long bones of this horse are often split for the extraction of the marrow and the skull broken for the brains. The shape of the teeth enables one to distinguish at once between the *Equus rectidens* and *Equus caballus* of Europe.

If we study now the geological strata of the Argentine Republic we may form the following table whose elements we borrow from Mons. Fl. Ameghino:

ETAGES.		EQUIDÆ QUI S'Y TROUVENT.
Aérien (actuel)		*Equus caballus domesticus.*
Aimara (récent)		(Pas trace d' *Equidæ*).
Platien (post-pampéen lacustre)		*Equus rectidens.*
Guerandien (post-pampéen marin)		(Pas de Mammifères terrestres).
Lujanien *Bonairien* *Belgranien* *Ensenadien*	Pampéen	*Equus rectidens.* *Equus argentinus.* *Equus curvidens.* *Hippidium* (5 sp.). *Hipphaplus* (2 sp.).

This table, in which the "ensenadien" formation is the most ancient, and the layer "aérien," or actual, the most modern, shows, in the most evident manner, that the true horse of South America (*Equus rectidens*) was extinct a long time when *Equus caballus*, coming from Europe, made his first appearance in the Argentine Republic.

Indeed, the "Aimara" formation, where the bones of the llama (*Auchenia guanaco*) are abundant, presents no trace whatever of the genus *Equus*.

This geological proof seems to me to be absolutely incontrovertible, and reduces to *nil* hypotheses built on the apocryphal documents left by an adventurer like Sebastian Cabot, the inaccuracies of which, not to say the fancies, are shown by the examples we have cited.

The true horse (*Equus*) has been scattered more widely, and has given rise to more species in North America than South America. It is interesting to recall here that the remains of *Equus caballus* have been discovered in the Quaternary beds (Pleistocene) of Canada and of Alaska. It is therefore certain that this species has existed in the *wild state* in the American Arctic region. But it is not less certain, according to all historical documents, that this animal had not existed for ages when it was introduced by Europeans in the early part of the 16th century. What is the cause which brought about the extinction of horses in North America as in South America before the commencement of the present period? This is not the place to discuss that question. But I cannot refrain from remarking that the extinction appears to have coincided with that of the *Proboscidians* (Elephant, Mastodon) and can consequently be attributed to the same causes which are to be sought in the environment of these *Herbivoræ* (nourishment, nature of the soil, etc.)

For the present it will suffice to establish that the *Mastodon superbus* was contemporaneous with the *Equus rectidens* in the in the Quaternary (Pleistocene) of the Argentine Republic. Also *Elephas primigenius* is found with *Equus caballus* in the same age in North America. All these types of animals became extinct in the New World, although horses and elephants have continued to live in Asia and in Africa up to the present time.

ADAPTATION OF SEEDS TO FACILITATE GERMINATION.

BY W. W. ROWLEE, CORNELL UNIVERSITY, ITHACA, N.Y.

THE observations recorded in these notes are based upon the general law of evolution, that organisms are constantly adapting themselves to secure advantages in their struggle for existence; and, because of this, it is to be expected that all modifications of organisms have some explanation in the economy of their existence.

From the initiation of the young plant into life at the time of fertilization of the ovule, to the end of the life of the mature plant, there is no more critical period in its existence than when it is dormant in the mature seed. It may be said in objection to this statement, that such seeds as corn, wheat, and garden seeds in general, when planted, almost all germinate, and this is true; but these seeds are removed by artificial intervention from the competition with which those planted naturally are compelled to struggle. These seeds, then, may be left out of consideration.

Careful observation of the seeds of native plants shows that a very large percentage of them never germinate. Some, no doubt, were never fertilized. I have counted a thousand seeds of different species of plants belonging to the Order Compositæ, and then planted them carefully, giving them as good, if not better, conditions for germination than they would have had if they had been planted naturally, with the result that in most of the species a comparatively small number germinated. Anyone who will take the trouble to search for seedlings of our native perennial plants, and compare the number they find with the number of seeds produced by the plant, will be convinced without further argument that the larger proportion of seeds produced by wild plants never germinate at all. In view of the critical period in the life of the plant when it is dormant in the seed as an embryo, and recognizing the evolutionary law of the survival of the fittest, is it not reasonable to expect that modifications of the seed will be developed which will facilitate germination? What are some of the modifications which increase the chances for germination of the seed?

In general, it may be said that seeds vary as to the structure of the parts within the coats, as well as to the external appendages of the outer coat. The internal characters are concerned with the embryo and the albumen. The embryo is the essential part of the seed. It consists of an initial stem, the hypocotyl, at each end of which is a growing point, one, the plumule, destined to produce the stem, the other, always at the other end of the hypocotyl (usually termed the lower end), from which the primary root starts. At the upper end of the hypocotyl, but below the plumule, are the cotyledons, sometimes large, sometimes small. Surrounding the embryo more or less, and inside the coats, is the material upon which the embryo is nourished until it can carry on an independent existence. This is termed the albumen of the seed. Around all are the seed-coats.

Moisture is as necessary to the germination of a seed as any other external condition. The necessity for moisture would make it highly probable that seeds should have special modifications to secure it to the seed. It is my purpose to point out some of the adaptations which seem to me to be designed to increase the facility and certainty of germination by securing and likewise keeping constant the supply of moisture for the seed. Some of the characters which will be mentioned have been considered as aiding the seed in its distribution. These are flattened or feathered appendages commonly known as pappus, coma, etc. It is not my purpose to belittle the office of distribution as performed by these organs, but it does seem to me true that, while these organs do assist the seed in dissemination, they, at the same time, aid in bringing it into the most advantageous position for germination. This advantage is often gained by the correlation of the internal parts of the seed, especially the growing points, to the external appendages of the seed or fruit. It is frequently the case that there is but one seed in the ovary, and the coats of the ovary closely invest the seed. Such a fruit is an akene. If the ovary- and seed-coats are completely fused together, the fruit is a caryopsis. For the purposes of our study these fruits may be included in the same category with seeds proper.

The correlation of parts in the seeds of many species is very striking. In the akenes of most of the species of the Order Compositæ it is especially noteworthy, and in several other orders seeds occur showing the same correlation. They might well be likened to an arrow. The feathered end is light, the head is heavy. In falling, the heavy part, i.e., the part which contains the embryo, is brought by the force of gravity invariably into close contact with the soil.

The same correlation of parts may been seen in the winged fruit of any species of maple. There is a very fruitful silver-leaved maple (A. dasycarpum) near my study. Under it passes a hard gravel path. The fruits that fell in the smooth path, of course, fell over on their side. Those that fell in the grass of the lawn, almost invariably assumed a position with the wing up and the body of the fruit down in the grass and leaves in contact with the moist soil. Further, I found that not a single seed in the path had germinated, when many of those in the grass had done so. It was interesting to see those large seeds all wing-up in the grass.

Most of the fruits of plants belonging to the Order Compositæ are especially adapted to facilitate germination. As is well known, the fruit is crowned with a pappus, which in a majority of cases not only acts like a parachute and bears the seed away, but at the same time lands it always a certain end up. The hypocotyl is very short in proportion to the length of the cotyledons, and is always in the lower end of the seed. Thus the growing points are brought into close and constant contact with the moisture of the soil. I have observed these akenes in fields and woods lodged usually, I might safely say, almost always, in such a position as to bring the akene with its lower tip in contact with the soil. If it fell in an open, smooth place, it would tip over, but, although reclining, would still have the lower tip upon the ground. If it fell among grass, leaves, or *débris* of any sort, as seeds are very apt to do, these would keep it in an upright position, and, on account of the barbed or upwardly roughened nature of many forms of pappus, it would work its way down until it came in contact with a suitable place for germination.

To determine whether this could be proven experimentally or not, I carefully selected a certain number of seeds of twenty different species, and planted one half of them one end up, the other half with the other end up. I had grave doubts about the success of the experiment, and should not have considered the proposition improbable had no differences in the rate of germination appeared.

All the seeds were placed under the soil and put as nearly as possible under the same conditions. Whenever the weather was dry, they were watered twice every day. Five species germinated twice as many seed when planted pappus end up as the same species did when planted pappus end down.

This at least suggests a reason for the inversion of the ovule in these and many other seeds. By assuming the anatropous form, the seeds in this order are able to bring their hypocotyl near the opening at the base of the akene, and at the same time secure advantages to themselves in the process of germination. I cannot help but believe that these adaptations are a factor in making the Order Compositæ the largest of the orders of flowering plants, in the number of its species as well as in the great abundance of individuals in some of its species.

WOMAN'S WORK FOR WAGES.

BY C. R. HENDERSON, RECORDER AND ASSISTANT PROFESSOR OF SOCIAL SCIENCE IN THE UNIVERSITY OF CHICAGO.

SOCIAL science has few more important problems than the conditions and effects of the earning of wages by women. Some sanguine advocates of women's rights apparently do not see that there are grave perils attending the enlargement of industrial activities on the part of the natural mistress of the home. They hail with rapture unmixed with foreboding the mere fact that the former "slaves of men" are becoming independent of the lords of creation. That access to new employments has its bright side there can be no reasonable doubt. There is a physical gain if the work is confined within certain limits and is adapted to the frame and forces of the sister toiler. Regular labor in sunny and well-ventilated rooms, or even in the open fields, is far better for health than idleness and husband-trapping. Intellectually, the sphere of mental life is vastly enlarged by the modern diversity of employment. There are domestic and social advantages in being able to wait and select a husband rather than take up the first thing in the shape of a man who offers a secure living. The economical advantage is so apparent that it needs nothing more than mention. At first sight all that a girl earns is clear gain, and is an absolute addition to the income of the family. In many occupations the dexterity, deftness, and honesty of female helpers have proved their superior value. As nurses, physicians of women and children, matrons of institutions requiring the presence of ladies, their gentleness and insight have been an untold blessing. These advantages are so real and great that any modifications of the present tendency to widen the industrial sphere of woman must take them into the account.

But there is also a very dark side to this subject. Passing the dangers of imposing labor prematurely on young girls, consider the indirect effects of feminine competition in some lines. That which we first see is a positive addition to family revenue. But later we discover that girls are taking the places of men at lower rates. This often means that the natural head and bread-winner is out of work or is receiving the woman's rate. The girl has herself to support, and that only in part. The man must support at least four persons. What must be the effect on domestic life? That which is actually observed: the husband and father at home while the daughter or wife is in the factory earning the living. Marriages are dimished, and among those most suitable for parents there are fewer births. A recent French economist of high repute gravely declares that the State ought to support and educate foundlings and orphans because the better members of society either cannot or will not keep up the population. What must be the results of propagating a human stock with such pedigrees? Ask the Kentucky horse-breeders. Think of the disorder of households where the normal conditions are reversed, the wife being in field or shop. Dr. Bushnell wrote about a "a reform against nature." It is against civilized human nature to throw the burdens of procuring sustenance upon those who have all they can endure in bearing, nursing, and starting the education of children. That cannot be a good tendency, economically or morally, which tends to extinguish a higher race. Herbert Spencer, in his pages on the *status* of women, gives abundant illustrations of the law that the imposition of bread-winning on women belongs with savage conditions.

What can be done to secure the advantages of women's work for wages and avoid the perils? There are natural forces which counteract the momentum of these evils. Fortunately it is the disposition of most women to have a home of their own. This inclination, deep as human life and old as history, removes much female competition. But unconscious forces need to be supplemented by foresight, prudence, and philosophy. Biology, as De Greef teaches, is not sociology. There is a physical law of "must" and a moral law of "may" and "ought." Women should be taught that she who works for less than normal wages in order to get "pin money" is the foe of her kind, and is undermining the foundations of economic and domestic welfare. This conviction, once generally diffused, will create trade-unions. These unions, because they are human, have done many foolish and wicked deeds. But they never did a more foolish or wicked deed than they have done who taught that unlimited work of women, at any price they could get, was an unmixed good. If women unite and demand the normal rate of wages then it will be found out whether it is really profitable to hire them. If their peculiar gifts give them superiority they will retain their places at the proper rate. If men are really more fit for the places, they will be preferred. Thus this social disease might be healed. To let it alone is to let a cancer alone, or permit incipient consumption or germs of cholera to have free-course. To take hold of the evil with will and unity is to cure it. Thus alone will young men be able to marry at a suitable age, and young women will generally find their most congenial and happy places as mothers and educators and home-makers. There is sufficient earning force in men without forcing children to eat scraps of bread and cake out of scavenger barrels and without compelling women to exhaust their energies in field and factory.

HEREDITY.

BY JULIA BROWN STRODE.

ALL men are created free and equal, says that famous document the Declaration of Independence, and, in a remote and abstract sense, it may be true; but, all in all, we are bound by a thousand chains, and equality is unknown. Fetters have been imposed upon us by our forefathers; limitations have been set us by our ancestors, which it will take years of study and self-culture to overcome. And as to equality, this man may average well in one particular with his fellow-men, but is totally deficient in another respect, and no two men are alike. Many of the lower tribes in Africa, says Stanley, resemble the ape more nearly than human beings. Either these lower classes have sprung from a brute ancestry, or their lives and environments have continued such that they have taken on the dispositions and appearance of the higher animals with which they have been surrounded, and have transmitted them to their progeny. Whether we accept the theory of evolution or not, the fact remains the same, i.e., that many savage tribes are more allied to animals than to civilized man. But, whatever our parentage is, or may have been, true worth is recognized and acknowledged wherever it may be found.

The problem of how to intensify the higher attributes of human nature and obliterate the unworthy is the problem of the age. The old theory that children were sent into the world, figuratively speaking, mere pieces of blank paper was long ago exploded. The paper is all written, traced, and re traced. The child has as decided a character, though not one so easily discernable, when it enters the world as when it leaves it. As genius, disease, peculiarities of appearance often transmit themselves from parent to children, so do villainy, crime, and moral depravity.

Here is a child with the idiosyncracies, the peculiar mannerisms, of his great-grandfather dead before he was born. I know of a boy whose attitudes and voice are like no other member of his family, but that of an uncle whom he never saw. Often an individual returning to his home town, from which he has for years been absent, readily determines to what families the new-born generation belongs.

Drunkenness is an inherited disease. A celebrated physician makes an estimate that one-fourth of the cases of insanity are inherited. A race of scholars beget a race of learned men, men with brains capable of receiving much knowledge. Says Oliver Wendell Holmes in one of his greatest novels: "There are races of scholars among us, in which aptitude for learning is congenital and hereditary. Their names are always on some catalogue or other. They break out every generation or two in some learned labor, which calls them up after they seem to have died out. At last some newer name takes their place it may be; but you inquire a little and find it is the blood of the Edwardses, or the Chaunceys, or the Ellerys, or some of the old historic scholars disguised under the altered name of some female descendant."

Of course, there are individuals and families continually working their way up into these intellectual classes, and their posterity will rank with them. But many of us have the way already paved for us in inherited aptitude and brain-power.

Often acquired traits are transmitted until they become a distinguishing characteristic of the race or family, a part of them as it were. Sometimes certain unions, "felicitous crosses," produce an improved strain of blood and a prodegy is born. A child adopted and far removed from its family usually shows forth the disposition of its own people. Occasionally such a one will escape. A generation or two may be skipped, but, sooner or later, the old hereditary traits reappear, breaking out in the blood of the race, no matter what the outer influences may be. Rev. Oscar C. McCulloch, in an address before the National Conference of Charities, stated his having traced a certain family back for the greater part of a century, until the individuals found belonging to it numbered over five thousand, all but one of whom were either vagabonds or criminals. But one of the entire number lived to be an honorable man. Says this reverend gentleman, as quoted by Edward S. Morse in a late number of the *Popular Science Monthly:* "Efforts have been made again and again to lift them, but they sink back. They are a decaying stock; they cannot longer live self-dependent. The children reappear with the old basket. The girl begins the life of prostitution, and is soon seen with her illegitimate child."

The entire populace of portions of our great cities is composed of an element such as this. Decency cannot exist within the borders of these slums. Truth cannot survive the diabolic cunning of the place. Missionaries and sanitary officers sent to aid this people are often murdered. "This class," says O. B. Fowler, "are an enormous expense to the State, a constant menace to society, a reality whose shadow is at once colossal and portentous." Millions of them every year start out over country as tramps, and return again to these quarters as winter sets in, to live by theft, crime, and beggary. Their increase is alarming. A race of vagabonds beget a race of vagabonds. What shall we do to prevent this increase? How shall we work a reformation? How shall we treat our criminals born, as it were, out of parallel with natural law? Shall such be allowed to beget a race in which their own characteristics are intensified? Shall such be treated as morally responsible for their misdoings? This is the great problem to be solved by our own and future generations.

"It is singular," says Holmes, "that we recognize all bodily defects that unfit a man for military service, and all intellectual ones that limit his range of thought; but always talk at him as if his moral powers were perfect. . . . I suppose," he continues, "that we must punish evil-doers as we extirpate vermin; but I don't know that we have any more right to judge them than we have to judge rats and mice, which are as good as cats and weasels, thought we think it necessary to treat them as criminals."

Truly, "the sins of the parent are visited on the children, even to the third and fourth generation." Truly, our influence is unending; our lives a blessing or a curse to all future time, just as the power and influence of the great past is interwoven within our own organizations.

Ah, yes! but hidden within this visible being is the *real man*, the overcomer, the spirit pure as when it left the Creator to be incarnated in mortal flesh. That let us recognize. Let us know ourselves, our faults and virtues, the chains that bind us, the aids that have been given us; but let us so recognize our own spirit lives, our real selves; let us so far become individualists that we are masters and not slaves to inherited tendencies. And let us attempt to solve this great problem, here cited, for the good of our fellow-men and the strengthening and bettering of future generations.

A CONSIDERATION OF THE CLAIMS OF CHEMISTRY AS THE BASIS OF MODERN AGRICULTURE.

BY FRANK T. SHUTT, M.A., CHIEF CHEMIST, DOMINION EXPERIMENTAL FARMS, OTTAWA, CANADA.

AGRICULTURE may be considered at once the oldest of all arts and the youngest of the sciences. It has always had for its object the economic production of plants and animals and the materials elaborated by them during their life. This fact gives us a definition for the term agriculture that was as correct centuries ago as it is now.

Until comparatively late years agriculture existed, as far as the farmer was concerned, as an art only. The application of scientific or classified knowledge to the feeding of plants and animals began with the researches of Liebig and Davy in the early part of the present century. Since then an ever-increasing band of scientists — now spread over the civilized world — has been studying this vast subject with gratifying results. Agriculture, properly so called, has now passed beyond the ranks of empiricism and entered the realms of science.

Strictly speaking, agriculture should not be called a science. The problems which it presents call for their solution upon chemistry, botany, zoölogy, geology, and physics. Mechanics are also more or less closely connected with agriculture as an art, and have been of immeasurable value in reducing the cost as well as increasing the yield of field-crops.

It is to chemistry and animal and vegetable physiology, however, that we look for the answers of innumerable questions that are continually arising in the development of those living things which the farmer has to deal with. Indeed, a little reflection will convince us that it is difficult to state an agricultural problem that does not make demands upon chemistry and physiology for its solution.

Chemistry has to do with the composition of all matter, inert and living, and the changes which such is constantly undergoing. The conversion of soil substances and the constituents of the air into vegetable tissues, and the formation from these of animal tissues and products, though not as yet fully understood, are, nevertheless, truly chemical changes. Looked at chemically, we see nature as the work-shop, plants and animals as the chief agencies, man as the director. The material worked with consists of a limited number of elementary substances and their compounds; plants and animals are continually performing with this material the operations of analysis and synthesis.

Physiology treats of the functions of living things and their various organs; it seeks to explain with the aid of chemistry all the phenomena of life. Living matter is made up of cells capable of nutrition and reproduction. As the result of cell development, animal and plant tissues are formed. The changes which take place in these cells, primarily leading to their nutrition, and secondarily to their reproduction, are true chemical transformations. It becomes clear, therefore, that physiology is largely chemistry, and that the latter science in many instances furnishes the foundation and explanation of vital or physiological processes.

Thus we establish the claim that chemistry forms the basis of scientific agriculture.

Leaving with this brief outline of the fundamental importance of chemistry in the abstract to agriculture, let us proceed to examine somewhat more in detail the aid that this science gives to the farmer. To pursue economically and intelligently, modern agriculture in any of its branches requires an application of the principles of chemistry, since every farm operation, whether performed by nature or man, implies, as may be inferred from what has already been said, changes of material which can only be explained by chemistry and its twin-sister science, physiology.

Chemistry affords definite knowledge as to the amounts of the several constituents taken from the soil by field-crops, thus indi-

cating what must be restored if fertility is to be maintained and lucrative yields obtained in the future. Such knowledge is well-nigh indispensable at the present day to the grower of grain, roots, and fruit if he is to compete successfully with his intelligent neighbors. Chemistry can tell us, in a large measure, of the relative fertility of a soil and point out what elements of plant-food may be lacking. It is the science that makes the barren and waste lands fruitful and is the chief agent in making "two blades of grass grow where there was but one before." To stock-raisers and dairy-farmers it lends its aid in showing the requirements of animals, the daily waste of the animal organism. It ascertains the composition and relative feeding-values of cattle-foods. It analyzes animal products, indicating their comparative worth. Chemistry stamps the value upon artificial fertilizers.

In the by-paths of agriculture, too, chemistry is of service. The intelligent investigator in the important subjects of insecticides and fungicides must prosecute his studies by the light of chemistry. And so we might proceed, but space forbids. Let us, however, remember that history emphatically shows that agriculture and agricultural chemistry have progressed with equal strides, and that for the future the indications are that the relationship of these two will be still closer.

If in this short sketch our claim is made good, then we perceive that it is of paramount importance that agricultural chemistry should form part of the education of every boy destined for the farm. Every public school in rural districts should teach it, not merely theoretically, but practically. All the officers of our experiment stations should have a knowledge of its principles, since no department of agriculture is independent of it. They at present are not only investigators but are also the teachers of the adult and practising farmer. How necessary it is then that all their work should be guided by an intimate acquaintance with that science which is not only the foundation of agriculture, but whose laws govern its operations.

THE REAL MOTIONS OF THE FIXED STARS.

BY PROFESSOR A. W. WILLIAMSON, AUGUSTANA COLLEGE, ROCK ISLAND, ILL.

IT is very often stated in newspapers, and also stated in a number of text-books on astronomy, that 1830 Groombridge has a greater velocity than the attraction of all known bodies in the universe could give it. We know not how many dead suns may exist, retaining their full power of attraction, though no longer giving light.

We do not, however, need this supposition to account for the velocity of 1830 Groombridge. Granting the laws of gravitation universal, we are able to account for any finite velocity, the attracting bodies possessing any finite degree of brightness, by supposing these bodies sufficiently large and distant.

Imagine a grand central sun just as dense as ours and a quintillion times as bright, in proportion to its surface. Suppose its distance 10^{72} times that of our sun. Suppose its periodic time 10^{54} times that of our earth. Its mass would be $(10^{72})^3 \div (10^{54})^2 = 10^{216} \div 10^{108} = 10^{108}$ times that of our sun. Its radius would be $\sqrt[3]{10^{108}} = 10^{36}$. Its apparent surface would be $(10^{54} \div 10^{36})^2 = (10^{18})^2 = 10^{36}$ times less than our sun. Its brightness would therefore be $10^{-36} \times 1$ quintillion $= 10^{-18}$ or .000000000000000001 part of that of our sun, that is, it would be as much fainter than an ordinary star as the star is fainter than the sun, invisible even by the Lick telescope.

Our system would therefore move in its orbit around this central sun as many times more rapidly than the earth moves in its orbit, as the diameter of the orbit is greater, divided by the number the periodic time is greater, that is $10^{72} \div 10^{54} = 10^{18}$. As our earth moves over eighteen miles in a second, our system must, on this supposition, move over eighteen quintillion miles in a second, or about one hundred trillion times the velocity.

It is difficult to conceive that so great a sun can have any real existence, and still more difficult to imagine we are moving with such velocity. It seems to me, however, not improbable that as the motion of the planets in their orbits is much greater than that of their satellites, so the motion of the stars around the common centre is far more rapid than that of the planets around our sun. It seems quite likely that all are moving in the same direction, and that the apparent motions of those having a sensible parallax are only the differences of their true motions. The sun may appear to be moving towards Hercules because it is moving in that direction more rapidly than the average of the stars. May it not also be the case that it is really moving in exactly the opposite direction but more slowly than other stars?

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

The Ancient Libyan Alphabet.

PROFESSOR KEANE in *Science*, Sept. 23, having acknowledged that he referred to the wrong book, should have been ingenuous enough to say that, in the book he did refer to, the primary form given of every letter in the Libyan alphabet is rectilinear, or a dot. As he was not, I offer to place the book in the hands of the editor of *Science* for anyone to convince himself that this is the case.

It is a strange misapprehension of the most important point at issue on the part of Professor Keane, to call the form of the letters "of secondary importance." Their disputed origin can be ascertained only by discovering their original forms.

If Professor Keane had further been ingenuous enough to state *why* Hanoteau likens the writing of the Touaregs to Arab and Hebrew, he could not have ventured the perfectly incorrect inference he fathers on Hanoteau, that it is "Semitic." Hanoteau refers solely to his belief that the Touareg writing is always read from right to left; in which opinion he was wrong, as I have plenty of documents in *tifinar* to show.

I shall say nothing further of Professor Keane's view of the pronunciation and meaning of the word *tifinar* than that every derivation I can find of it by French scholars regards the initial *t* as part of the radical; which would effectually dispose of the fanciful hypothesis that it comes from *Phœnician*.

D. G. BRINTON.

Media, Penn., Sept. 27.

Twins Among the Indians on Puget Sound.

TWINS among the Indians of Puget Sound are very uncommon; but in former times, when any did appear, they had an exceedingly hard time, as the Indians were superstitiously afraid of them. During the past eighteen years, I have known of but one pair among the Twana Indians, and one pair among the Clallams. The Twanas were well taken care of, as the parents had always lived on the reservation, where the Indian agent had previously had a pair; and so they had had an opportunity of seeing the white customs in regard to them. These parents had also been educated in school, and were quite civilized. To all intents and purposes they were white, and so nothing was done about them except that there was some talk about the former customs in regard to them.

But the pair among the Clallams did not fare so well. Their parents were old-fashioned Indians, were surrounded by old-fashioned Indians, were about eighty miles from the reservation, and they had never had a home on it. The home of their parents was in Fort Discovery, but they were at Neah Bay, catching seals, about eighty miles from home at the time the twins were born. Immediately the Neah Bay Indians became afraid of them, and quickly drove them and their parents away, as they were afraid that the twins would scare all the fish away from their waters. Accordingly, the parents returned to Port Discovery on a steamer, though the Indians were quite unwilling to have them go in that way, fearing that they would frighten all the fish away; and earnestly wished them to walk the entire distance, over mountains and through the forests or on the beach, although there was neither beach or road much of the way.

When they reached home, some of the old Indians of their own tribe were very much afraid. They threatened to kill one of the twins, so that the father did not dare to leave home. Hence he could not go off and work and earn food; neither would they allow him to fish near his home, although the fish at that time were very abundant there, for fear that all the fish would leave. Hence the man was greatly troubled to get food enough for his family to keep them from starving. They told him to live on clams. They would not go near his house if it could be avoided, and, if they had to pass it, would make quite a detour around.

It is said that long ago, when such an event occurred, the other Indians drove the fortunate or unfortunate mother into the woods with the twins, — the father going also if he wished, — and there they had to live alone, and they were not to return as long as both twins were alive; one must be disposed of in some way. If any friends pitied them enough to furnish them with food, it was carried to some place where the parents were not present, and then, when the carrier had retired, the parents could take it to their lonely home.

Other tribes on the Pacific coast had somewhat similar customs, while others honored the twins greatly, according to the reports of the British Association for the Advancement of Science, which speak of them in British Columbia, and Power's "Tribes of California," which speaks of them in that State. M. EELLS.

Union City, Wash., Sept. 12.

Prevention of Cholera Asiatica.

IN an article on "Prevention of Cholera Asiatica," printed in *Science*, September 23, I wished to give a way to detect the bacillus; inadvertently stating Gram's solution colored the germ, — it does *not* do so, — but that fact forms one of its distinguishing characteristics. However, the cholera (comma) bacillus is colored by a watery solution of fuchsin. HUGH HAMILTON.

Harrisburg, Pa., Sept. 24.

A Large Southern Telescope.

THE wide interest in astronomical research is well illustrated by the frequent gifts of large telescopes to astronomical observatories by wealthy donors who are not themselves professional students of astronomy. The number of these gifts is continually increasing, and in no department of science has greater liberality been displayed. Unfortunately, the wisdom shown in the selection of good locations for the telescopes has not equalled the generosity with which they have been given. Political or personal reasons, rather than the most favorable atmospheric conditions, have in almost all cases determined the site. These telescopes have been erected near the capitals of countries or near large universities, instead of in places where the meteorological conditions would permit the best results to be obtained. The very conditions of climate which render a country or city great, are often those which are unfavorable to astronomical work. The climate of western Europe and of the eastern portion of the United States is not suited to good astronomical work, and yet these are the very countries where nearly all the largest observatories of the world are situated. The great number of telescopes thus concentrated renders it extremely difficult for a new one to find a useful line of work. The donor may therefore be disappointed to find so small a return for his expenditure, and the opinion has become prevalent that we cannot expect much further progress in astronomy by means of instruments like those now in use. The imperfections of our atmosphere appear to limit our powers, and are more troublesome relatively with a large than with a small telescope. Accordingly, it has not been the policy of the Harvard College Observatory to attempt to obtain a large telescope to be erected in Cambridge. In order to secure the greatest possible scientific return for its expenditures, large pieces of routine work have by preference been undertaken, which could be done with smaller instruments. These conditions are now, however, changed. A station has been established by this Observatory near Arequipa, in Peru, at an altitude of more than eight thousand feet. During a large part of the year the sky of Arequipa is nearly cloudless. A telescope having an aperture of thirteen inches has been erected there, and has shown a remarkable degree of steadiness in the atmosphere. Night after night atmospheric conditions prevail which occur only at rare intervals, if ever, in Cambridge. Several of the diffraction rings surrounding the brighter stars are visible, close doubles in which the components are much less than a second apart are readily separated, and powers can be constantly employed which are so high as to be almost useless in Cambridge. In many researches the gain is as great as if the aperture of the instrument was doubled. Another important advantage of this station is that, as it is sixteen degrees south of the equator, the southern stars are all visible. A few years ago a list was published of all the refracting telescopes having an aperture of 9.8 inches or more (*Sidereal Messenger*, 1884, p. 193). From this it appears that nearly all of the largest telescopes are north of latitude + 35°, although this region covers but little more than one-fifth of the entire surface of the earth. None of the seventeen largest and but one of the fifty-three largest telescopes are south of this region. Of the entire list of seventy-four, but four, having diameters of 15, 11, 10, and 10 inches, are south of + 35°. The four largest telescopes north of + 35° have apertures of 36, 30, 29, and 27 inches, respectively. But few telescopes of the largest size have been erected since this list was prepared, and the proportion north and south is still about the same. It therefore appears that about one-quarter of the entire sky is either invisible to, or so low that it cannot be advantageously observed by, any large telescope. The Magellanic clouds, the great clusters in Centaurus, Tucana, and Dorado, the variable star η Argus, and the dense portions of the Milky Way, in Scorpius, Argo, and Crux, are included in this neglected region. Moreover, the planet Mars when nearest the earth is always far south. The study of the surface of this and of the other planets is greatly impeded by the unsteadiness of the air at most of the existing observatories. Even under the most favorable circumstances startling discoveries — relating, for example, to the existence of inhabitants in the planets — are not to be expected. Still, it is believed that in no other way are we so likely to add to our knowledge of planetary detail as by the plan here proposed. The great aperture and focal length and the steadiness of the air will permit unusually high magnifying powers to be employed, and will give this instrument corresponding advantages in many directions, — for instance, in micrometric measures, especially of faint objects. It can be used equally for visual and photographic purposes; and in photographing clusters, small nebulæ, double stars, the moon, and the planets, it will have unequalled advantages.

A series of telescopes of the largest size (including four of the six largest, the telescopes of the Lick, Pulkowa, U. S. Naval, and McCormick Observatories) has been successfully constructed by the firm of Alvan Clark & Sons. But one member of the firm now survives, Mr. Alvan G. Clark; and he expresses a doubt whether he would be ready to undertake the construction of more than one large telescope in the future. The glass is obtained with difficulty, and often only after a delay of years. A pair of discs of excellent glass suitable for a telescope having an aperture of forty inches have been cast, and can now probably be purchased at cost, $16,000. The expense of grinding and mounting would be $92,000. A suitable building would cost at least $40,000. If the sum of $200,000 could be provided, it would permit the construction of this telescope, its erection in Peru, and the means of keeping it at work for several years. Subsequently, the other funds of this Observatory would secure its permanent employment. Since a station is already established by this Observatory in Peru, a great saving could be effected in supervision and similar expenses, which otherwise would render a much larger outlay necessary.

An opportunity is thus offered to a donor to have his name permanently attached to a refracting telescope which, besides being the largest in the world, would be more favorably situated than almost any other, and would have a field of work comparatively new. The numerous gifts to this Observatory by residents of Boston and its vicinity prevent the request for a general subscription; but it is believed that if the matter is properly presented, some wealthy person may be found who would gladly make the

requisite gift, in view of the strong probability that it will lead to a great advance in our knowledge of the heavenly bodies. Any one interested in this plan is invited to address the undersigned.

EDWARD C. PICKERING,
Director of the Observatory of Harvard College.

Cambridge, Mass., U.S.A., September, 1892.

Naltunne Tunne Measures.

WHEN the writer was at the Siletz Agency, Oregon, in 1884, he obtained the following units of measurement from Alex. Ross, the chief of the Naltunne tunne, an Athapascan people:—

1. The double arm's length, from the meeting of the tips of the thumb and forefinger of one hand to the meeting of the tips of the thumb and forefinger of the other hand.

2. Single arm's length, "one arm," extending from the tip of the middle finger along the extended arm to the shoulder-joint.

3. From the middle of the sternum along the extended arm to the meeting of the tips of the thumb and index finger.

4. From the inner angle of the elbow to the meeting of the tips of the thumb and index finger.

5. From the middle of the fore-arm to the meeting of the tips of the thumb and index finger.

6. From the first wrinkle of the wrist to the meeting of the tips of the thumb and index finger.

7. The width of the hand (when grasping a stick), "one grasp," equal to the width of four fingers (No. 11).

8. One finger width. 9. Two finger widths. 10. Three finger widths.

11. Four finger widths (the hand being open), equal to No. 7.

12. Five finger widths (including the thumb).

13. From the joint of the right shoulder horizontatly across the body to the meeting of the tips of the thumb and forefinger of the extended left arm.

14. From the tip of the right elbow (the right arm being bent and held horizontally, the hand touching the shoulder) horizontally across the body to the tip of the middle finger of the left hand, the left arm also being extended horizontally.

J. OWEN DORSEY.

Takoma Park, D.C., Sept. 13.

Omaha Arrow-Measure.

THE Omaha use the following as their arrow-measure: From the inner angle of the elbow to the tip of the middle finger, and thence over the back of the hand to the wrist-bone.

J. OWEN DORSEY.

Takoma Park, D.C., Sept. 13.

BOOK-REVIEWS.

Elementary Text-Book of Entomology. By W. F. KIRBY. Second Edition. Revised and augmented. Ill. New York, Macmillan & Co. 281 p. 8°. $3.

ENTOMOLOGISTS everywhere will welcome with pleasure this new edition of Kirby's handbook of reference to the study of insects. As compared with the first edition of the work, we find the present one improved by the addition of a carefully prepared index, and by an appendix and table of contents. The appendix adds considerable new and valuable matter, while the last-named feature answers admirably to present the main divisions of the classification of insects used by the author. Various schemes of the latter are briefly discussed in the introduction, but our space will only admit of our saying here that seven orders are adopted to which the lesser groups of all insects are referred. These are the *Coleoptera* (including *Strepsitera*), *Orthoptera* (including *Euplexoptera* and *Dictyoptera*), *Neuroptera* (including *Trichoptera*, *Thysanura*, *Collembola*, *Mallophaga*, and *Thysanoptera*), *Hymenoptera*, *Lepidoptera*, *Hemiptera* or *Rhynchota* (including the suborders *Hemiptera — Heteroptera* and *Hemiptera — Hemoptera*, and the *Anoplura*), and *Diptera* (including *Aphaniptera* and possibly *Achreioptera*). Our author tersely defines these several

Publications Received at Editor's Office.

DOBBIN, L. and WALKER J. Chemical Theory for Beginners. New York, Macmillan & Co. 16°. 244 p. 70 cts.

GEOLOGICAL SURVEY OF TEXAS. Annual Report, 1891. Austin, State. 8°. Paper. 470 p.

KIRBY, W. F. Elementary Text-Book of Entomology. New York, Macmillan & Co. 8°. 282 p. Ill. $3.

WILKINSON, GEORGE. The Voice. 16°. Paper. 72 p.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

For Sale or Exchange.—The subscriber would like to receive cash offers, or an offer in exchange for the earlier volumes of Poggendorf's Annalen and the later volumes of Silliman's Journal, upon the following list: Chenn —Manuel de Conchyliologiè. 2 vols. Nearly 5,000 figures, some hand-colored. Paper. Paris, 1859. Edwards.—Butterflies of N. A. 2 vols. Plates hand-colored. Vol. I., half calf Vol. II. in parts. Leyman, Agassiz, Hagen.—Ills. Cat. Mus. Comp. Zoel. at Harvard. No. I. Ophiuridae. No. II., Acalephae. No. III., Astacidae. All bound in one volume. American Naturalist. Vols. I.-VII. Cloth. Silliman's Am. Jour. of Science and Arts. Third Series. Vols. I.-X. Cloth. Binney.—Terrestrial Mollusks of N. A. Colored plates. 4 vols. Stretch.—Zygaenidae and Bombycidae of N. A. Colored plates. Also a considerable library of monographs, reports, and scientific books, and a large number of duplicates of fossils, minerals and shells. E. A. STRONG, Ypsilanti, Mich., Sept., 1892.

Exchange.—I have the finest shells of Anodonta corpulenta, C'p'r, and Suborbiculata, Say, in the world. Will exchange for fresh water, land, and marine shells, in large or small quantities. Have also for exchange 50 varieties of fresh water and land shells from Spoon River, Ill. DR. W. S. STRODE, Lewistown, Ill.

To exchange for books on birds or insects, or for back volumes of American Naturalist: Ecker's "Anatomy of the Frog," Packard's "Guide," Guyot's "The Earth and Man," Rockhill's, "The Land of the Lamas," Parker's "Biology," Shoemaker's "Heredity, Health and Personal Beauty," Dexter's "The Kingdoms of Nature," all new. M. J. ELROD, Ill. Wes. Univ., Bloomington, Ill.

For Sale.—About 1087 volumes of the private library of Dr. Nicolas León, formerly director of the Museum at Morelia, embracing publications of special value for Mexicologists, like those of Bishop Zumárraga (16th century), of Siguenza y Gongora, of Aleman, etc., the Missal of Spinoza, all very scarce; manuscripts on the history of Michoacán and other Mexican States, on the Tarasco (the Indian language of Michoacán) and several works, of which the only copy known to exist is in this collection. Parties interested in the sale please address DR. NIC. LEÓN, Portal de Matamoras, Morelia, Mexico.

Wants.

METALLURGICAL CHEMIST will give instruction in the metallurgy and chemical analysis of iron and steel. Complete or special courses applying to the manufacture of pig irons and steels as well as to their uses. Address "METALLURGIST," care SCIENCE.

A GRADUATE of the University of Pennsylvania and a practical mineralogist of twenty years' experience desires to give his services and a cabinet of 25,000 specimens, all named, with about the same number of duplicates, in minerals, crystals, rocks, gems, fossils, shells, archæological and ethnological specimens and woods to any institution desiring a fine outfit for study. The owner will increase the cabinet to 50,000 specimens in two years and will act as curator. Correspondence solicited from any scientific institution. J. W. Hortter, M.D., Ph.D., San Francisco, Cal., General P. O. Delivery.

WANTED.—A position as zoological artist in connection with a scientific expedition, institution or individual investigations. Experienced in microscopic and all scientific work. References given if desired. Address J. HENRY BLAKE, 7 Prentiss Place, N. Cambridge, Mass.

CHEMIST AND ENGINEER, graduate German Polytechnic, Organic and Analytical, desires a position in laboratory or chemical works. Address 213½ E. 7th Street, New York, care Levy.

A MAN, 36 years old, of extensive experience, having the degrees of A.M. and Ph.D., desires a first-class opening as a teacher of Zoölogy and kindred studies in a college or university. Can furnish numerous testimonials or references as to success and skill in most modern laboratory methods. Address E. W. D., Md. Agr. College, College Park, Md.

A JOHNS HOPKINS graduate (1892) desires a position as instructor in mathematics and physics. Address A. B. TURNER, Johns Hopkins University, Baltimore, Md.

A YOUNG MAN, with a thorough training in Analytical Chemistry (including analysis of minerals, food, water, etc.), and holding a diploma of the School of Practical Science, of Toronto, and good testimonials, desires a position as Analytical Chemist or as assistant to such. Address to WM. LAWSON, 16 Washington Ave., Toronto, Ontario.

groups under their respective heads, in the various divisional chapters of the books which they constitute, while the minor groups below orders are treated under sections of these chapters with more or less detail.

Mr. Kirby, being an Englishman and a member of the British Museum staff, it is no more than natural that in his volume he has given British entomology especial consideration, but in so doing he has hardly impaired its value for a text-book to the science of the entire subject. Indeed, the American entomologist's library will be lacking a most useful auxiliary to monographic treatises unless possessed of a copy of this manual. Of all the species making up his seven orders, he states that no less than 12,600 are to be found in Britain, as compared with the 270,000 making up the insect fauna of the world. We see the book's greatest weakness in his introduction, where not sufficient attention has been given to the anatomy of insects, their study from a general standpoint, their distribution in time, their taxonomy and similar matters, all of which give the works of Packard such a peculiar value. Not a single cut illustrates the fourteen pages devoted to his introduction in a volume of nearly three hundred. On the other hand, it would be hard to accord too much praise to the 650 figures contained on 87 plates that embellish the book. To the general student, as a means of diagnosis of the main groups, they must prove of the very greatest assistance, portrayed as they are with marked accuracy, strength, and clearness. For the purpose mentioned, the *Coleoptera* are especially good, bold, and well drawn, though perhaps lacking in that refinement of detail which lends such beauty to the productions of Riley's pencil. Throughout the pages of Mr. Kirby's work we are pleased to find that he has not altogether neglected to consider the economic importance, or the reverse, of many insects to the agriculturalist, and to vegetation, forests, and plant-life, generally — a department now attracting such universal attention in this country.

Upon the whole, we may say that this handsomely gotten-up manual presents but little for adverse criticism, when we come to consider what the volume aims to give, while it offers a great deal to commend it, and it is a work that any entomologist in this country will be proud to see upon the shelves of his library, as it is one that the student of entomology will be constantly called upon to consult. R. W SHUFELDT.

Primitive Man in Ohio. Vol. I. By WARREN K. MOOREHEAD. New York, G. P. Putnam's Sons. 246p. 8vo. Illustrated.

THE problem, Who were the mound builders? has long been one which has interested students of the antiquities of the valley of the Ohio, without much unanimity of conclusion on the part of those who undertook to answer it. Whoever these ancient peoples were, Mr. Moorehead and his collaborators in the work before us have been enabled by a series of admirably conducted investigations to throw a new light on their arts and institutions. These collaborators are Mr. Gerard Fowke, Dr. H. T. Cresson, and Mr. W. H. Davis; each of whom contributes one or two chapters to the book, on special fields.

After an opening chapter on palæolithic man, there are descriptions of excavations in various sites, the most celebrated of which are Fort Ancient, Madisonville, and Hopewell's Tumuli. The discoveries in the latter were especially rich, and will figure prominently in the archæological department of the Chicago Exhibition. They are particularly interesting as indicative of an extended use of metals, notably copper.

An examination of the skulls unearthed shows the contemporary existence of two groups, the one short-headed, the other long-headed; or, are they simply two cranial forms within the same population? This seems quite as likely.

The illustrations in the work are faithfully and well executed from the objects, and add both to the beauty and utility of the volume.

TO THOSE INTERESTED IN SCIENCE.

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